

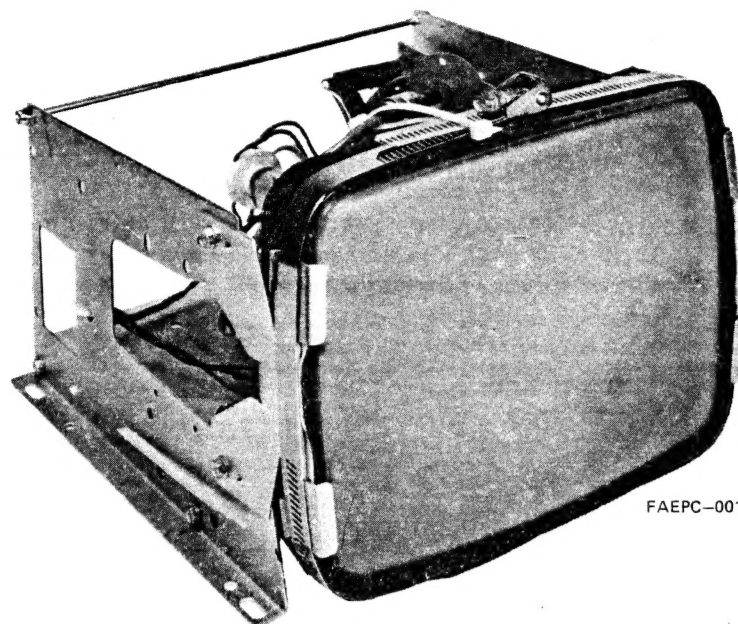


MOTOROLA

Service Manual

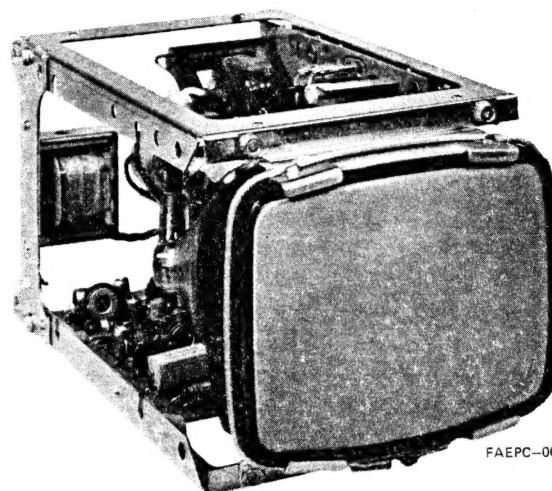
VP16

DATA PRODUCTS



FAEPC-00139

MODEL M2000 (9"—CRT)



FAEPC-00140

MODEL M1000 (5"—CRT)

MODEL	CHASSIS
M1000-1ST	C5VP115
M1000-1SC	5VP115
M2000-1ST	N/A
M2000-1SC	N/A

GENERAL INFORMATION

The models described herein are fully transistorized (except CRT) and applicable for displaying alphanumeric characters. The four models are as follows:

M1000-1SC (5" CRT)/M2000-1SC (9" CRT) — Operate with composite video inputs only.

M1000-1ST (5" CRT)/M2000-1ST (9" CRT) — Operate with separate TTL level vertical/horizontal sync and video inputs only.

The CRT'S employed are of the magnetic deflection type with integral implosion protection. An operating voltage of 12 volts DC @ 650 mA (typical) is required from an external power supply for the M1000 models. The M2000 models require an external 12 volts DC @ 900 mA (typical).

Input and output connections for the monitor are made through a 10-pin edge connector on the signal circuit card. Inputs consist of video, horizontal/vertical sync, +12 volts and ground. Output connections are provided for an optional remote brightness control.

Two plug-in etched circuit cards are utilized, a signal circuit card and a deflection circuit card. Components are mounted on the top of the circuit cards and copper foil on the bottom. Schematic reference numbers are printed on the top and bottom of each circuit card to aid in the location and identification of components for servicing. All standard operating/adjustment controls are mounted in a convenient manner on both circuit cards.

Circuitry consists of four stages for video amplification, six stages for horizontal/vertical sync and deflection processing, and one stage for video blanking during retrace. The M2000 models also provide dynamic focusing, which is a function of the horizontal output circuitry.

CAUTION

NO WORK SHOULD BE ATTEMPTED ON ANY EXPOSED MONITOR CHASSIS BY ANYONE NOT FAMILIAR WITH SERVICING PROCEDURES AND PRECAUTIONS.

MOTOROLA Data Products

CAROL STREAM, ILLINOIS 60187

SAFETY WARNING

CAUTION: NO WORK SHOULD BE ATTEMPTED ON AN EXPOSED MONITOR CHASSIS BY ANYONE NOT FAMILIAR WITH SERVICING PROCEDURES AND PRECAUTIONS.

1. SAFETY PROCEDURES should be developed by habit so that when the technician is rushed with repair work, he automatically takes precautions.

2. A GOOD PRACTICE, when working on any unit, is to first ground the chassis and to use only one hand when testing circuitry. This will avoid the possibility of carelessly putting one hand on chassis or ground and the other on an electrical connection which could cause a severe electrical shock.

3. Extreme care should be used in HANDLING THE PICTURE TUBE as rough handling may cause it to implode due to atmospheric pressure (14.7 lbs. per sq. in.). Do not nick or scratch glass or subject it to any undue pressure in removal or installation. When handling, safety goggles and heavy gloves should be worn for protection. Discharge picture tube by shorting the anode connection to chassis ground (not cabinet or other mounting parts). When discharging, go from ground to anode or use a well insulated piece of wire. When servicing or repairing the monitor, if the cathode ray tube is replaced by a type of tube other than that specified under the Motorola Part Number as original equipment in this Service Manual, then avoid prolonged exposure at close range to unshielded areas of the cathode ray tube. Possible danger of personal injury from unnecessary exposure to X-ray radiation may result.

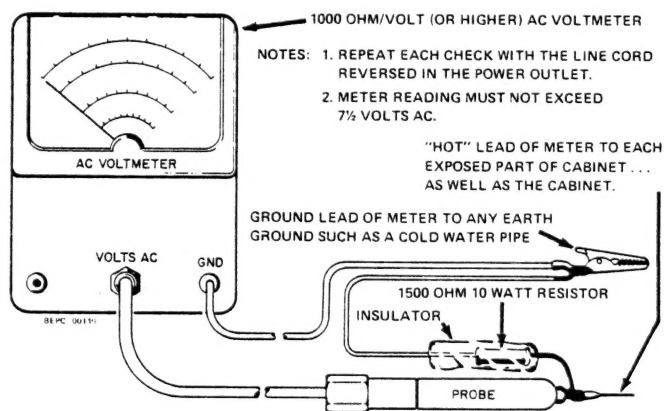
4. An ISOLATION TRANSFORMER should always be used during the servicing of a unit whose chassis is connected to one side of the power line. Use a transformer of adequate power rating as this protects the serviceman from accidents resulting in personal injury from electrical shocks. It will also protect the chassis and its components from being damaged by accidental shorts of the circuitry that may be inadvertently introduced during the service operation.

5. Always REPLACE PROTECTIVE DEVICES, such as fishpaper, isolation resistors and capacitors and shields after working on the unit.

6. If the HIGH VOLTAGE is adjustable, it should always be ADJUSTED to the level recommended by the manufacturer. If the voltage is increased above the normal setting, exposure to unnecessary X-ray radiation could result. High voltage can accurately be measured with a high voltage meter connected from the anode lead to chassis.

7. BEFORE RETURNING A SERVICED UNIT, the service technician must thoroughly test the unit to be certain that it is completely safe to operate without danger of electrical shock. DO NOT USE A LINE ISOLATION TRANSFORMER WHEN MAKING THIS TEST.

In addition to practicing the basic and fundamental electrical safety rules, the following test, which is related to the minimum safety requirements of the Underwriters Laboratories should be performed by the service technician before any unit which has been serviced is returned.



Voltmeter Hook-up for Safety Check

A 1000 ohm per volt AC voltmeter is prepared by shunting it with a 1500 ohm, 10 watt resistor. The safety test is made by contacting one meter probe to any portion of the unit exposed to the operator such as the cabinet trim, hardware, controls, knobs, etc., while the other probe is held in contact with a good "earth" ground such as a cold water pipe.

The AC voltage indicated by the meter may not exceed 7½ volts. A reading exceeding 7½ volts indicates that a potentially dangerous leakage path exists between the exposed portion of the unit and "earth" ground. Such a unit represents a potentially serious shock hazard to the operator.

The above test should be repeated with the power plug reversed, when applicable.

NEVER RETURN A MONITOR which does not pass the safety test until the fault has been located and corrected.

ELECTRICAL SPECIFICATIONS *

	MODEL M1000	MODEL M2000
PICTURE TUBE (CRT):	5" measured diagonally (127 mm); 13 sq. in. viewing area (84 sq. cm); 55° deflection angle; P4 phosphor standard	9" measured diagonally (228 mm); 44 sq. in. viewing area (284 sq. cm); 90° deflection angle; integral implo- sion protection; P4 phosphor standard
POWER INPUT:	12V DC at 650 mA	12V DC at 900 mA
INPUT SIGNALS:	COMPOSITE VIDEO INPUT; 0.5V to 2.5V composite P/P, sync negative (in- put impedance: 74 ohms terminated, 12k ohms unterminated), or TTL SEPARATE 2.5V to 5.0V P/P, video drive, sync positive at HORIZONTAL, input VERTICAL, VIDEO: (input impedance: 75 ohms to 250 ohms video termination, >2k ohms vertical and horizontal)	
RESOLUTION:	650 lines center, 500 lines corners	
VIDEO RESPONSE:	Within -3 dB, 10 Hz to 12 MHz	
LINEARITY:	Within 2% as measured with standard EIA ball chart and dot pattern	
HIGH VOLTAGE:	9.5 kV at 50 uA beam current, nominal	
HORIZONTAL RETRACE TIME:	11.0 uSec maximum	
SCANNING FREQUENCY:	Horizontal: 15,750 Hz ±500 Hz; Vertical: 50/60 Hz	
ENVIRONMENT:	Operating temperature: 0° C to 50° C Storage temperature: -40° C to +65° C Operating altitude: 10,000 feet maximum (3048 meters) Designed to comply with applicable DHEW rules on X-Radiation Designed to enable listing under UL Specification 478	
TYPICAL DIMENSIONS:	4.60" H, 5.12" W, 8.68" D (without power supply) (117 x 130 x 220 mm)	7.25" H, 9.50" W, 9.48" D (184 x 241 x 241 mm)

* Specifications subject to change without notice.

TABLE OF CONTENTS

GENERAL INFORMATION	1
SAFETY WARNING	2
SERVICE NOTES	4
BLOCK DIAGRAM	6
THEORY OF OPERATION	6
CHASSIS PARTS LOCATION (M1000 & M2000)	10
SCHEMATIC DIAGRAM (M1000)	11
SIGNAL/DEFLECTION CIRCUIT CARDS (COMPONENT SIDE VIEW)	12
SIGNAL/DEFLECTION CIRCUIT CARDS (SOLDER SIDE VIEW)	13
SCHEMATIC DIAGRAM (M2000)	14
REPLACEMENT PARTS LIST	15

SERVICE NOTES

CIRCUIT TRACING

Component reference numbers are printed on the top and bottom of the plug-in circuit cards to facilitate circuit tracing. In addition, control names and circuit card terminal numbers are also shown and referenced on the schematic diagrams in this manual.

Transistor elements are identified as follows:

E — emitter, B — base, and C — collector.

COMPONENT REMOVAL

Removing components from an etched circuit card is facilitated by the fact that the circuitry (copper foil) appears on one side of the circuit card only and the component leads are inserted straight through the holes and are not bent or crimped.

It is recommended that a solder extracting gun be used to aid in component removal. An iron with a temperature controlled heating element would be desirable since it would reduce the possibility of damaging the circuit card foil due to over-heating.

The nozzle of the solder extracting gun is inserted directly over the component lead and when sufficiently heated, the solder is drawn away leaving the lead free from the copper foil. This method is particularly suitable in removing multi-terminal components.

POWER TRANSISTOR REPLACEMENT

When replacing the "plug-in" transistor, please observe the following precautions:

1. The transistor heat sink is not "captive", which means that the transistor mounting screws also secure the heat sink. When installing the transistor, the heat sink must be held in its proper location.
2. When replacing the plug-in transistor, silicone grease (Motorola Part No. 11M490487) should be applied evenly to the top of the heat sink and bottom of the transistor.
3. The transistor mounting nuts must be tight before applying power to the monitor. This insures proper cooling and electrical connections. **NON-COMPLIANCE WITH THESE INSTRUCTIONS CAN RESULT IN FAILURE OF THE TRANSISTOR AND/OR ITS RELATED COMPONENTS.**

— NOTE —

Use caution when tightening transistor mounting nuts. If the screw threads are stripped by excessive pressure, a poor electrical and mechanical connection will result.

CRT REPLACEMENT

Use extreme care in handling the CRT as rough handling may cause it to implode due to high vacuum. Do not nick or scratch glass or subject it to any undue pressure in removal or installation. Use goggles and heavy gloves for protection. In addition, be sure to disconnect the monitor from all external voltage sources.

1. Discharge CRT by shorting 2nd anode to ground; then remove the CRT socket, deflection yoke and 2nd anode lead.
2. Remove CRT from chassis by loosening the one screw that secures the CRT mounting strap or retaining ring.

HORIZONTAL OSCILLATOR ADJUSTMENT

Step 1. Turn on monitor and set up for normal operation.

Step 2. Locate the HORIZ. HOLD control, R35, on the Signal circuit card.

Step 3. Begin rotating R35 CCW until the video display is out of horizontal sync. At this point rotate R35 back CW until the video display just locks in horizontally; then stop. Using tape, mark the left-hand edge of the video display (not the raster edge) of the CRT faceplate.

Step 4. Continue rotating R35 CW until the video display is out of horizontal sync again in the opposite direction. At this point rotate R35 back CCW until the video just locks in horizontally; then stop. Mark the left-hand edge of the video display on the CRT faceplate again.

Step 5. Observe the distance between the two marks on the CRT faceplate. The object is to rotate the HORIZ. HOLD control, R35, until the left-hand edge of the video display is centered between the two marks on the CRT faceplate.

VIDEO BIAS ADJUSTMENT

Step 1. With the monitor operating, rotate the CONTRAST control, R6, for minimum contrast; then disconnect the input signal(s).

Step 2. Connect a voltmeter across R18 (negative probe toward the collector of Q4).

Step 3. Adjust the VIDEO BIAS control, R14, for a $+1.0 \pm 0.05$ volt indication.

Step 4. Disconnect the voltmeter.

Step 5. Reconnect the input signal(s) and adjust the CONTRAST control, R6, for desired contrast.

HORIZONTAL LINEARITY ADJUSTMENT

— NOTE —

This adjustment procedure is required only when a CRT and/or deflection yoke have been replaced.

PROCEDURE

Step 1. Disconnect monitor from power supply.

Step 2. (M2000 ONLY) Locate the S-SHAPING transformer, T3, on the deflection circuit card; then rotate its slug down to the bottom. (This action temporarily minimizes the effect of T3 being in the circuit.)

Step 3. (Refer to Figure 1.) Loosen the deflection yoke clamp screw just enough to permit sliding the copper sleeve on the CRT neck back and forth.

Step 4. (Refer to Figure 1.) Position the copper sleeve so that only $1/8"$ (.125") extends out past the rear lip of the deflection yoke. In addition, be sure that the overlap edge of the copper sleeve is aligned properly and not twisted.

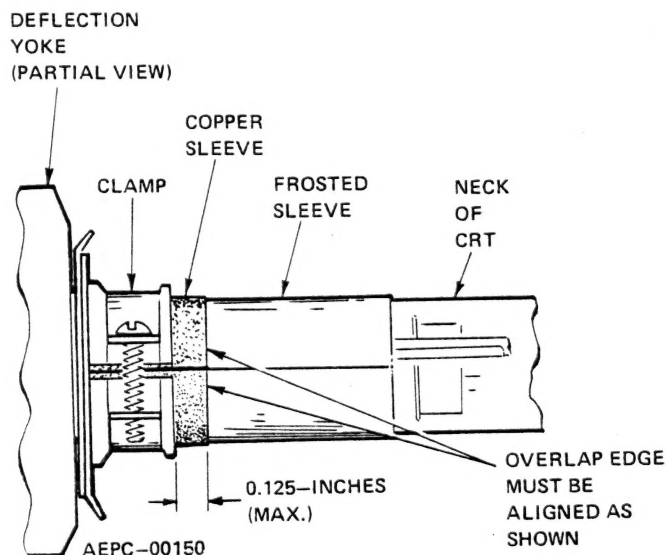


Figure 1. Partial View of CRT Neck/Deflection Yoke for Horiz. Linearity Adjustment

Step 5. Tighten the clamp screw carefully so as not to disturb the yoke position.

Step 6. Connect the monitor to its power supply and set up for normal operation.

Step 7. (Refer to Figure 2.) Observe the extreme left-hand edge characters (designated "A" in Figure 2). Its width should be equal to the width of the right-hand edge characters (designated "B" in Figure 2). If character "A" is wider than character "B", the copper sleeve is extending out too far. If "A" is narrower than "B", the copper sleeve should be pulled out further. In any event, the copper sleeve may have to be repositioned by trial and error if the 0.125-inch dimension does not provide desired linearity. Continue until the width of character "A" is equal to the width of character "B".

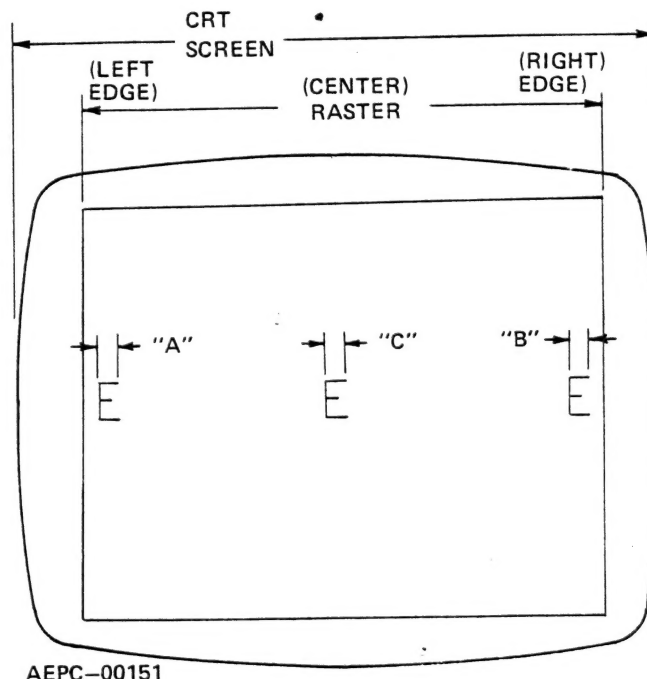


Figure 2. Partial CRT Raster Display of Characters for Adjustment

— NOTE —

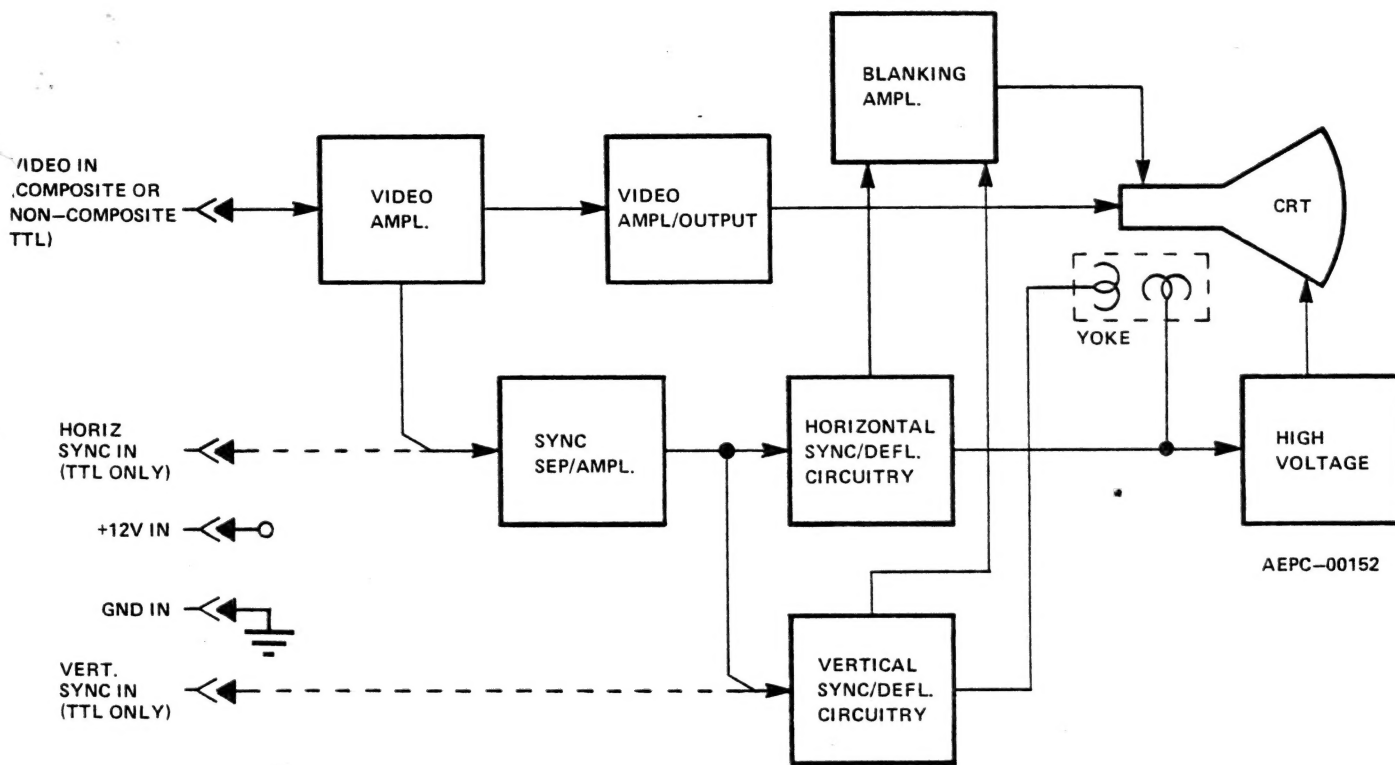
Steps 8–11 are applicable only for the M2000 monitor.

Step 8. With the M2000 monitor turned on and operating normally, observe the width of the center character (designated "C" in Figure 2). It should be narrower than characters "A" and "B".

Step 9. Connect an oscilloscope (AC coupled) between the blue wire pin (on deflection circuit card) and chassis ground. A parabolic waveform should appear.

Step 10. Begin rotating the slug of T3 upward (away from circuit card) until the amplitude of the waveform is 125 volts P-P. This setting will equalize the width of character "C" to that of characters "A" and "B".

Step 11. Disconnect oscilloscope.



Block Diagram

THEORY OF OPERATION

GENERAL

The following circuit description is applicable to monitors using a composite video signal as its input. For monitors using TTL inputs, the description is basically the same. However, the horizontal and vertical sync pulses are coupled from an external source through separate inputs, as is the non-composite video. In addition, jumpers JU1 and JU2 will be inserted in the TTL position.

VIDEO AMPLIFIER CIRCUIT

(Reference Figure 3.)

The video amplifier consists of four stages that include Q1, Q2, Q3 and Q4. The first stage, Q1, functions as an emitter

follower. The low output impedance of this first stage permits use of a low resistance CONTRAST control, R6, which furnishes flat video response over its entire range without the need for compensation. The collector output of Q1 is used to drive the sync separator, Q5. Capacitor C2 provides high frequency roll-off to limit the collector output to the bandwidth required to pass synchronization signals.

Transistors Q2 and Q3 form a direct coupled amplifier with frequency compensation provided by C40 and C41. The output from Q3 is capacitively coupled (C5) to the base of Q4, video output stage. The video bias control, R14, is used to set the quiescent collector current of Q4. Frequency compensation is provided by R17 and C6. The combined action of clamping diode D1 and capacitor C5 provide DC restoration for the video signal.

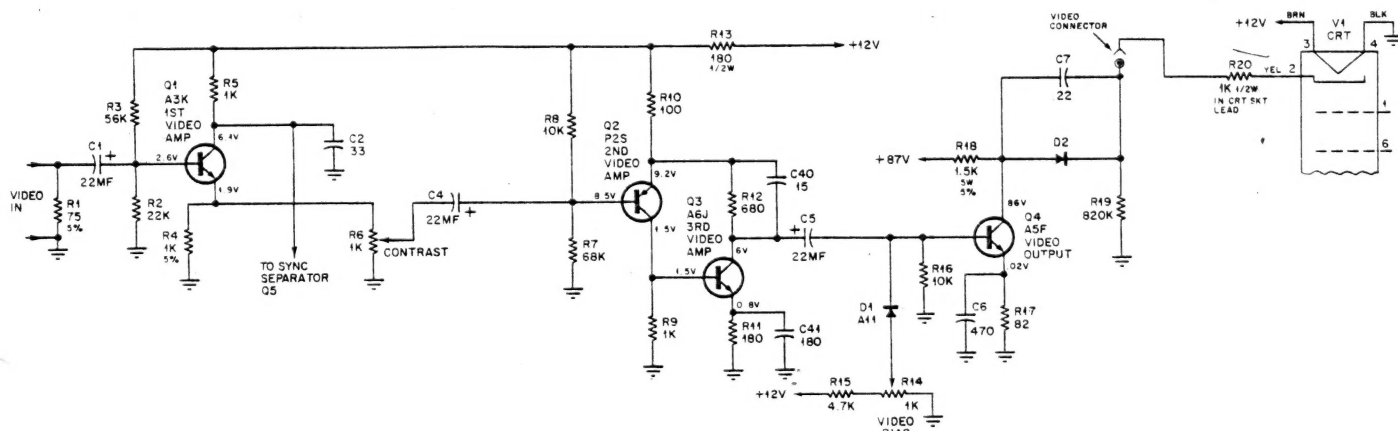


Figure 3. Video Amplifier Circuit

Components C7, D2 and R19 provide CRT beam current limiting. Diode D2 is normally forward-biased; therefore, as Q4 conducts, its collector voltage drops. This causes a larger beam current to flow through R19, which in turn causes its voltage drop to rise. If excessive beam current flows, the voltage developed across R19 becomes greater than the collector voltage of Q4. This action reverse-biases D2, which prevents a further increase in beam current. Capacitor C7 helps couple video to the CRT cathode, pin 2, through R20. Resistor R20 is used to isolate Q4 from transients that may occur as a result of CRT arcing.

SYNC SEPARATOR/AMPLIFIER CIRCUIT

(Reference Figure 4.)

The sync separator employs two stages. Transistor Q5 is the sync separator and Q6 is the sync amplifier. The video input to the sync separator is black positive. Capacitor C3 is charged by the peak base current that flows when the positive peak of the input takes Q5 to saturation. This charge depends on the peak to peak input to Q5 and thus makes the bias for Q5 track the amplitude of the input signal. As a result, Q5 amplifies only the positive peaks of the input signal. The initial bias current through R23 sets the clipping level.

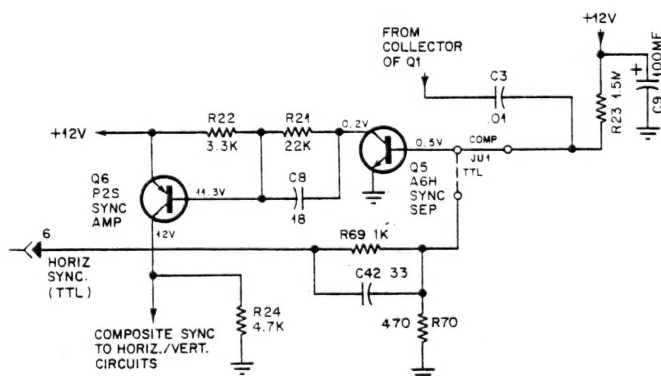


Figure 4. Sync Separator/Amplifier Circuit

PHASE DETECTOR (AFC)

(Reference Figure 5.)

The phase detector control consists of two diodes (D3 & D13) in a keyed clamp circuit. Two inputs are required to generate the required output, one from the sync amplifier, Q6, and one from the horizontal output circuit, Q8. The required output must be of the proper polarity and amplitude to correct phase differences between the input horizontal sync pulses and the horizontal time base. The horizontal output (Q8) collector pulse is integrated into a sawtooth by R28, C13 and R29. During horizontal sync time, both diodes conduct, which shorts C13 to ground. This effectively clamps the sawtooth on C13 to ground at sync time. If the horizontal time base is in phase with the sync (waveform A), the sync pulse will occur when the sawtooth is passing through its AC axis and the net charge

on C13 will be zero (waveform B). If the horizontal time base is lagging the sync, the sawtooth on C13 will be clamped to ground at a point negative from the AC axis. This will result in a positive DC charge on C13 (waveform C). This is the correct polarity to cause the horizontal oscillator to speed up to correct the phase lag. Likewise, if the horizontal time base is leading the sync, the sawtooth on C13 will be clamped at a point positive from its AC axis. This results in a net negative charge on C13, which is the required polarity to slow the horizontal oscillator (waveform D).

Passive components R30, R31 and C16 comprise the phase detector filter. The bandpass of this filter is chosen to provide correction of horizontal oscillator phase without ringing or hunting. Optional capacitor C14 (when present) times the phase detector for correct centering of the picture on the raster.

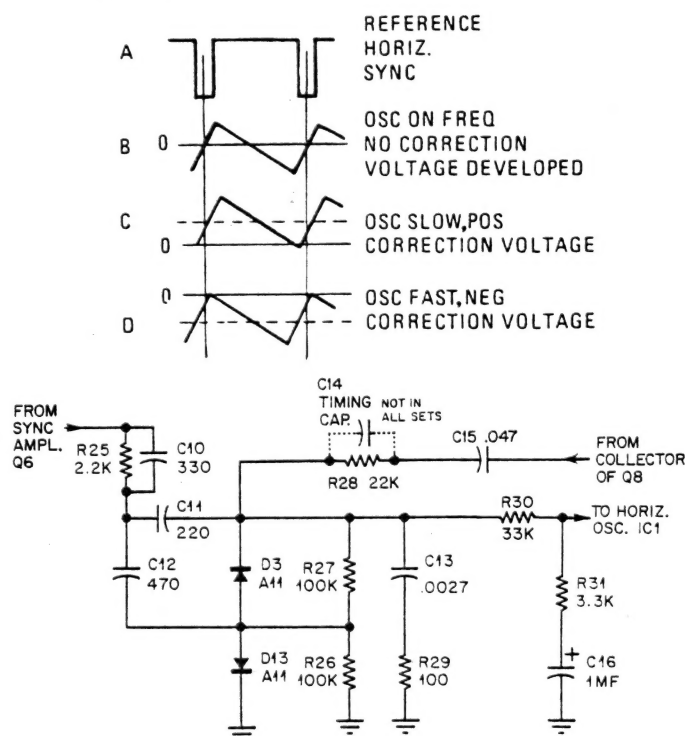


Figure 5. Phase Detector (AFC) Circuit

HORIZONTAL OSCILLATOR AND DRIVER

(Reference Figure 6.)

The horizontal oscillator consists of integrated circuit IC1, which is essentially a voltage controlled oscillator with variable mark-space ratio (duty cycle) and internal voltage reference. The reference voltage is present at pin 6, while resistors R37 and R38 determine the mark-space ratio. The main oscillator timing capacitor is C17, with its charging current derived from three sources: (a) a fixed current from R33, (b) a variable current from R34 and HORIZ. HOLD control R35, (c) and a correcting current from the phase detector (AFC) network through R32. The combination of these three charging currents and C17 determine the horizontal frequency.

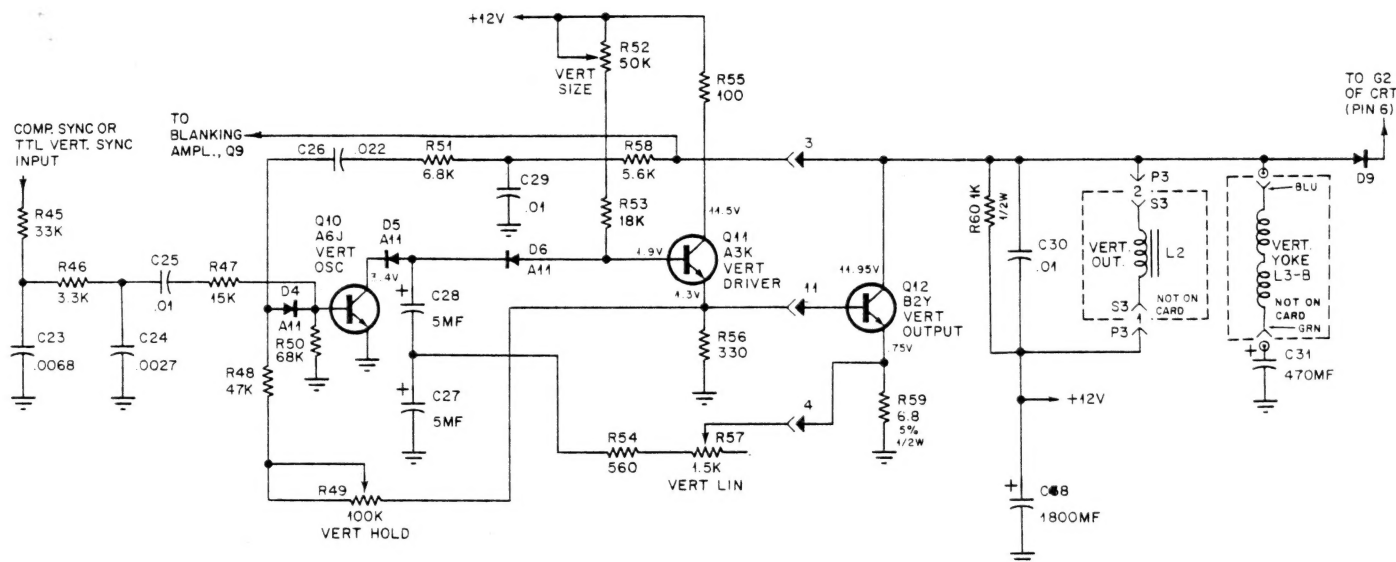


Figure 7. Vertical Circuit

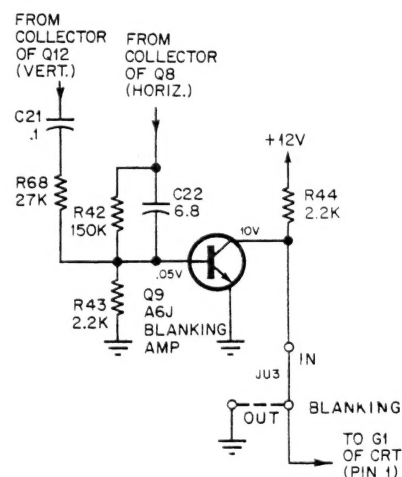
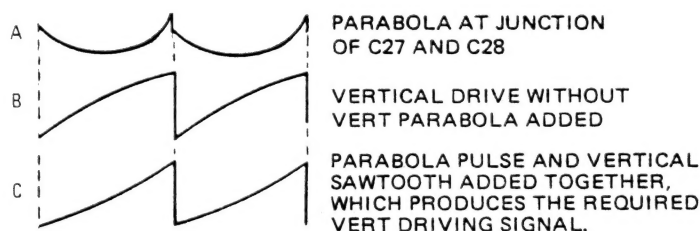


Figure 8. Blanking Amplifier

provide a feedback signal to Q10 to maintain oscillation in the event vertical sync pulses are not present. Diodes D5 and D6 provide the proper voltage drops to operate Q12 class A.

Vertical linearity is maintained by applying the ramp voltage generated across R59, through R57 (VERT LIN control) and R54, to the junction of C27 and C28. Since this path is resistive, the waveform will be integrated into a parabola by C27 (waveform A). This results in a predistortion of the ramp waveform (waveform C). (Waveform B illustrates the drive sawtooth without parabola shaping.) Parabolic shaping is necessary to compensate for the non-linear charging of C27 and C28, and the impedance change occurring in L2 with current. Capacitor C31 serves to remove the DC component of the vertical deflection yoke current. Diode D9 clamps the collector voltage of Q12 to a safe level.

RETRACE BLANKING

(Reference Figure 8.)

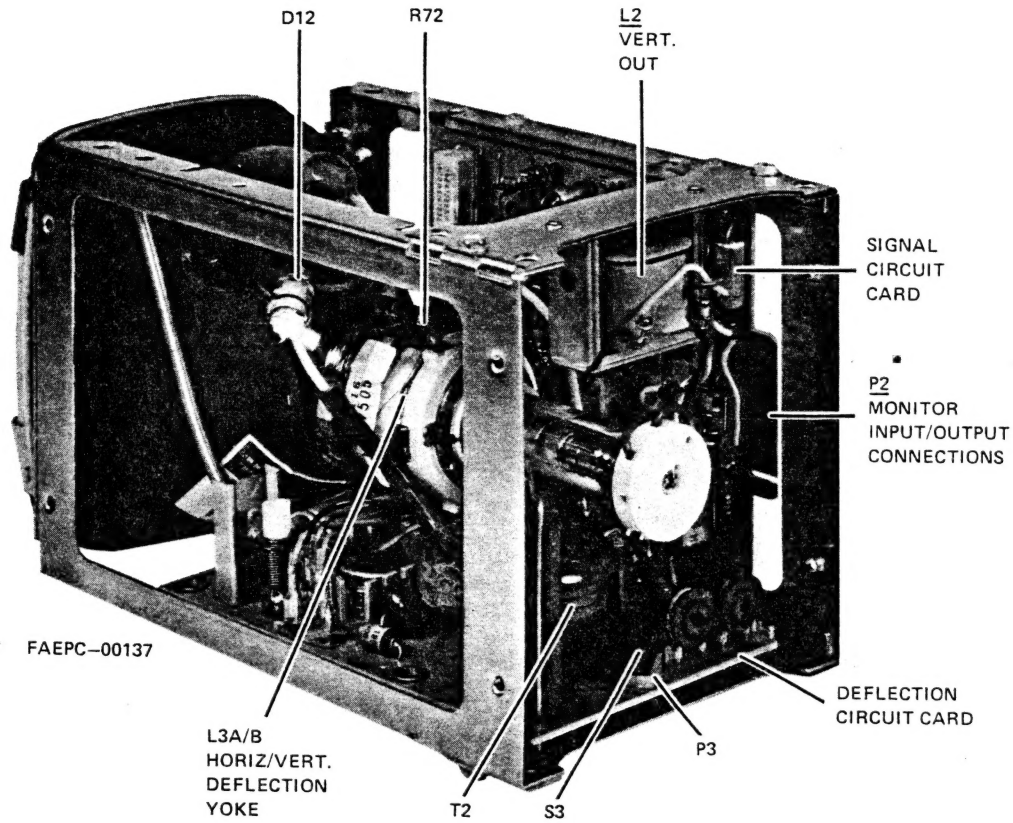
Retrace blanking is provided by negative-going horizontal and vertical rate pulses applied to G1 of the CRT. The collector pulse from the horizontal output stage, Q8, is developed across R43 through R42 and C22. The collector pulse from the vertical output stage, Q12, is differentiated by C21 to remove the sawtooth portion of the waveform. The remaining pulse appears across R43. The mixed vertical and horizontal pulses on R43 are amplified and inverted by the blanking amplifier, Q9, and applied to G1 of the CRT.

DYNAMIC FOCUS (M2000 ONLY)

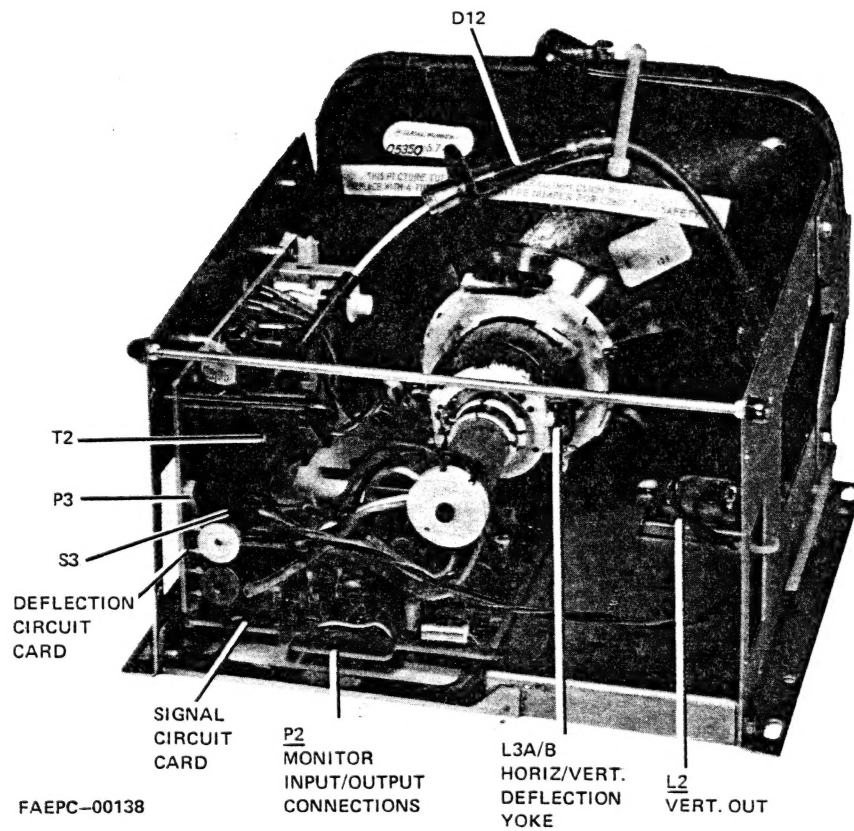
(Reference Figure 6.)

Due to the geometry of a CRT, the electron beam travels a greater distance when deflected to a corner as compared to the distance traveled at the center of the CRT screen. As a result of these various distances traveled, optimum focus can be obtained at only one point. An adequate adjustment can be realized by setting the focus while viewing some point midway between the center of the CRT screen and a corner, thus optimizing the overall screen focus. One of the simplest methods for improvement is to modulate the focus voltage at a horizontal sweep rate. Now optimum focus voltage is made variable on the horizontal axis of the CRT, which compensates for the beam travel along this axis.

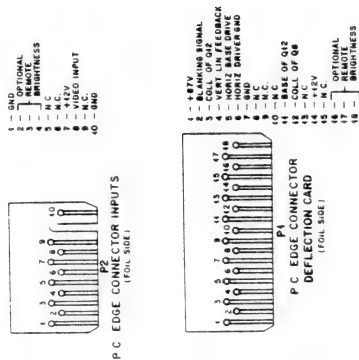
In the M2000, the secondary of T3 generates a parabolic voltage, which together with a fixed voltage from the FOCUS control R61, is applied to the focus grid of V1. This system dynamically changes the value of focus voltage from the CRT screen center to screen edge, which will always provide an optimum amount of voltage for best overall focus.



Model M1000 — Rear Chassis View



Model M2000 — Rear Chassis View



NOTES

VOLTAGE MEASUREMENTS

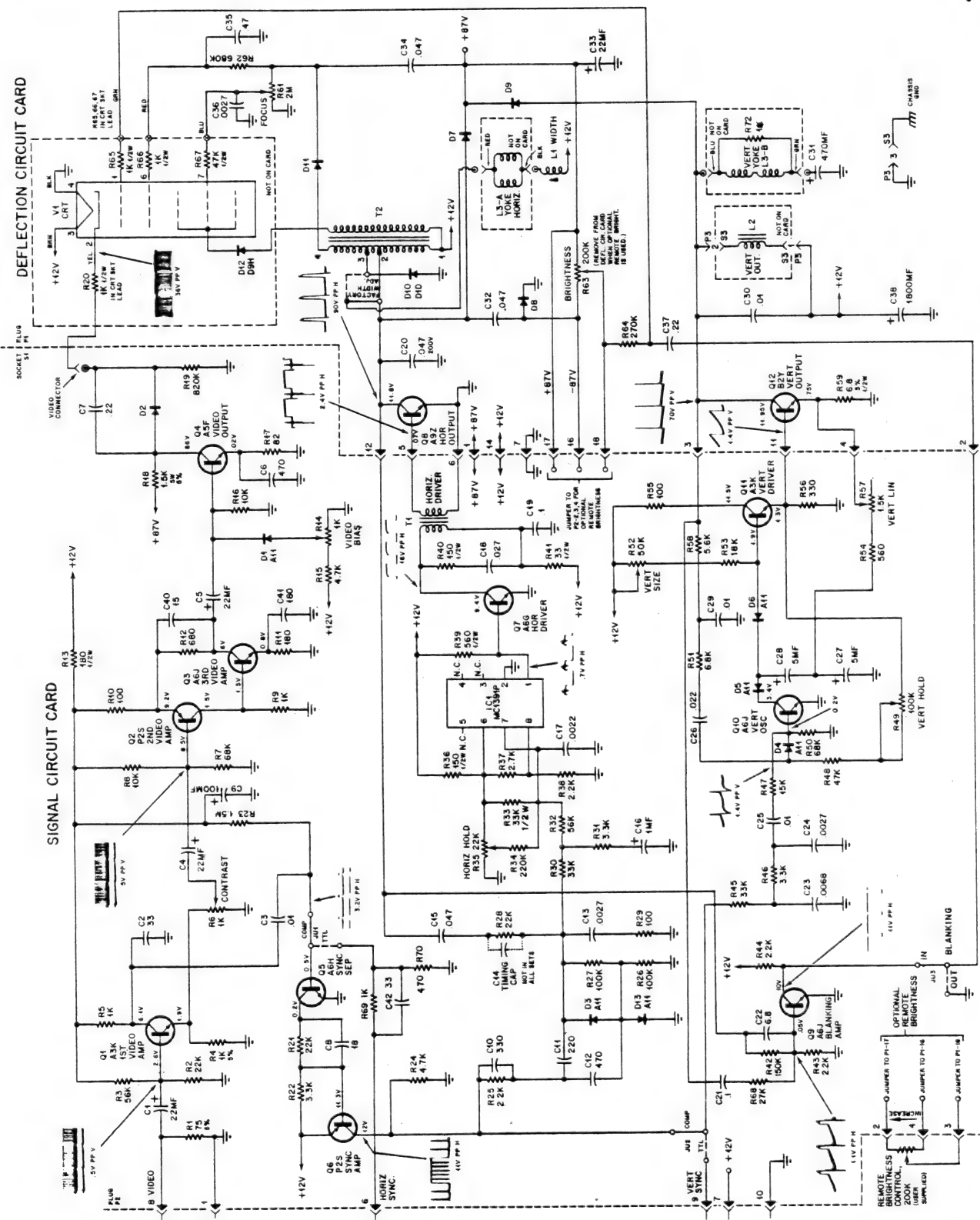
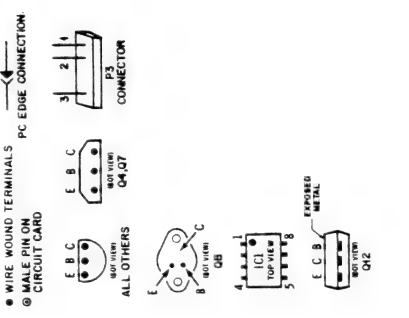
1. TAKEN FROM POINT INDICATED TO CHASSIS
2. TAKEN WITH CONTRAST & BRIGHTNESS CONTROLS AT MAXIMUM. ALL OTHER CONTROLS IN NORMAL OPERATING POSITION
3. TAKEN WITH 5V PP INPUT SIGNAL
4. TAKEN WITH 5V PP INPUT SIGNAL
5. TAKEN WITH 5V PP INPUT SIGNAL
6. TAKEN WITH 5V PP INPUT SIGNAL
7. TAKEN WITH 5V PP INPUT SIGNAL
8. TAKEN WITH 5V PP INPUT SIGNAL
9. TAKEN WITH 5V PP INPUT SIGNAL
10. TAKEN WITH 5V PP INPUT SIGNAL
11. TAKEN WITH 5V PP INPUT SIGNAL
12. TAKEN WITH 5V PP INPUT SIGNAL
13. TAKEN WITH 5V PP INPUT SIGNAL
14. TAKEN WITH 5V PP INPUT SIGNAL
15. TAKEN WITH 5V PP INPUT SIGNAL
16. TAKEN WITH 5V PP INPUT SIGNAL
17. TAKEN WITH 5V PP INPUT SIGNAL
18. TAKEN WITH 5V PP INPUT SIGNAL

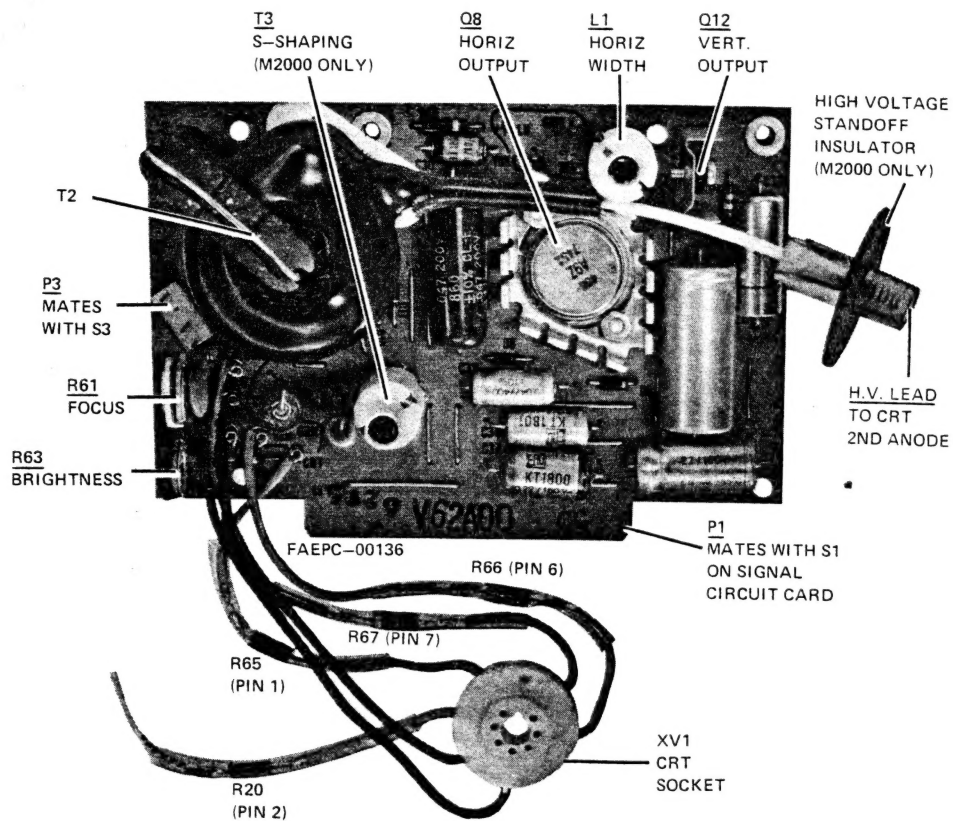
UNLESS OTHERWISE SPECIFIED IN MF. ALL OTHERS PF

RESISTOR VALUES ONLY ARE SHOWN

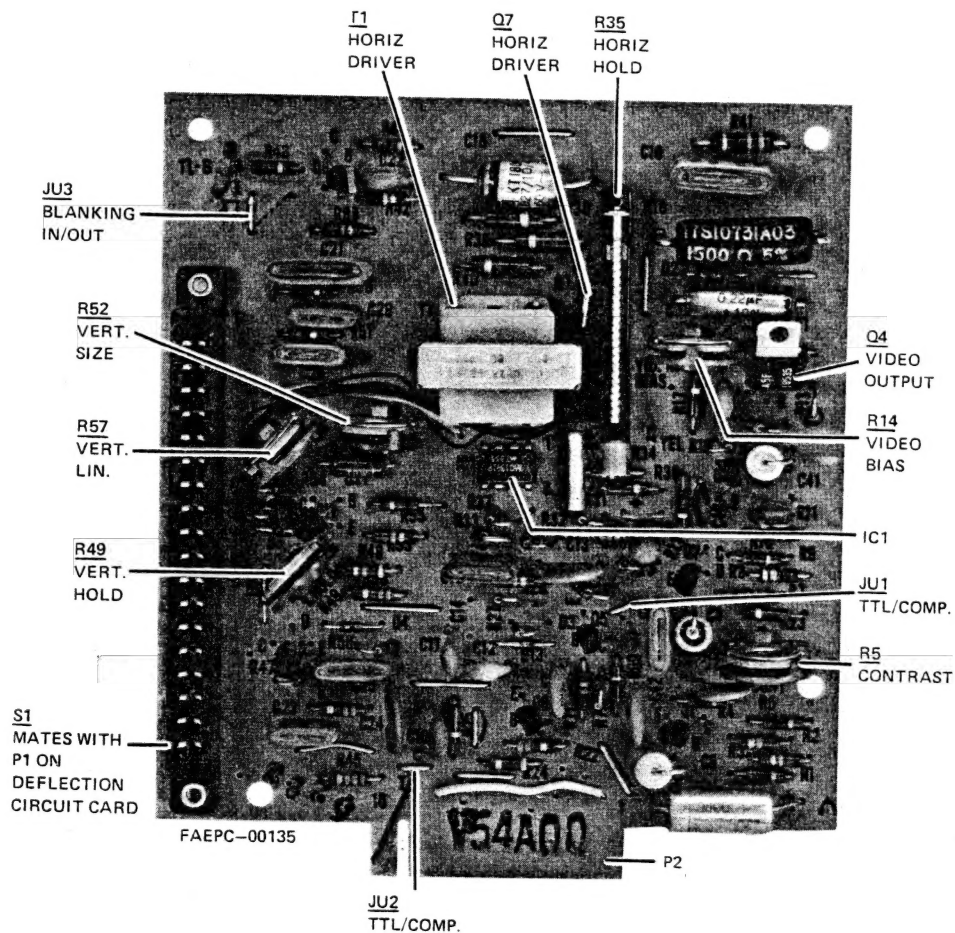
FOR COMPLETE DESCRIPTION OF CAPACITORS, REFER TO PARTS LIST

RESISTORS ARE 10% 1/4W EXCEPT AS NOTED.





Deflection Circuit Card - Component Side



Signal Circuit Card - Component Side

REPLACEMENT PARTS LIST

REF. NO.	PART NUMBER	DESCRIPTION	REF. NO.	PART NUMBER	DESCRIPTION
MONITOR CIRCUIT CARDS (COMPLETE): Order by Model Number and description.			TRANSISTORS		
CAPACITORS: (All values are in microfarads unless otherwise noted)			Q1	48S134997	1st Video Ampl.; A3K
C1	23S187A26	22, 40V; lytic	Q2	48S137127	2nd Video Ampl.; P2S
C2	21S180C64	33 pF 10%, N750, 100V; Cer Disc	Q3	48S137172	3rd Video Ampl.; A6J
C3	8S10191B98	.01 10%, 250V; Polyester	Q4	48S137093	Video Output; A5F
C4, 5	23S187A26	22, 40V; lytic	Q5	48S137171	Sync Sep.; A6H
C6	21S180B53	470 pF 10%, X5F; Cer. Disc	Q6	48S137127	Sync Ampl.; P2S
C7	8S10212A91	0.22 10%, 250V; Mtlz Poly	Q7	48S137169	Horiz. Driver; A6G
C8	21S180C52	18 pF 5%, NP0; Cer. Disc	Q8	48S137462	Horiz. Output; A9Z
C9	23S10255A06	100, 16V; lytic	Q9	48S137172	Blanking Ampl.; A6J
C10	21S131625	330 pF 10%, X5F; Cer. Disc	Q10	48S137172	Vert. Osc.; A6J
C11	21S180B87	220 pF 10%, X5F; Cer. Disc	Q11	48S134997	Vert. Driver; A3K
C12	21S180B53	470 pF 10%, X5F; Cer. Disc	Q12	48S137598	Vert. Output; B2Y
C13	21S180C41	.0027 10%, Z5F; Cer. Disc	RESISTORS/CONTROLS		
C15	8S10191B91	.047 10%, 250V; Polyester	Note: Only power or special resistors are listed. Use the description when ordering standard values of fixed carbon resistors up to 2 watts.		
C16	23S10229A07	1.0, 15V; Tant. lytic	R6	18D25245A02	Control, Contrast 1k
C17	8S10299B24	.0022 10%, 400V; Poly Carb	R14	18D25245A02	Control, Video Bias 1k
C18	8S10191B88	.027 10%, 400V; Polyester	R18	17S10731A03	1.5k 5%, 5W; Wire Wound
C19	8S10191C02	0.1 10%, 250V; Polyester	R35	18C25267A01	Control, Horiz. Hold 22k
C20	8S10072A44	.047 10%, 200V; Polyester	R49	18D25245A15	Control, Vert. Hold 100k
C21	8S10191C02	0.1 10%, 250V; Polyester	R52	18D25245A20	Control, Vert. Size 50k
C22	21S180D93	6.8 pF ± 0.5 NP0; Cer. Disc	R57	18D25245A10	Control, Vert. Lin. 1.5k
C23	8S10191B97	.0068 10%, 400 V; Polyester	R61	18D25245A12	Control, Focus 2 Meg.
C24	21S180C41	.0027 10%, Z5F; Cer. Disc	R63	18D25245A07	Control, Brightness 200k
C25	8S10191B98	.01 10%, 250V; Polyester	TRANSFORMERS		
C26	8S10191B89	.022 10%, 250V; Polyester	T1	25D25221A04	Transformer, Horiz. Driver
C27, 28	23S10218A31	5.0, 15V; Tant. lytic	T2	24D25291B02	Transformer, High Voltage (M1000 only)
C29	8S10191B98	.01 10%, 250V; Polyester	T2	24D25291B03	Transformer, High Voltage (M2000 only)
C30	8S10191A16	.01 10%, 400V; Polyester	T3	24D25248A09	Transformer, S-Shaping (M2000 only)
C31	23S10255A29	470, 16V; lytic	MISC. ELECTRICAL PARTS		
C32	8S10191B07	.047 10%, 400V; Polyester	V1	96S10769A01	5"-CRT, Type No. 140ANB4 (M1000 only)
C33	23S10255A74	22, 160V; lytic	V1	96S10793A01	9"-CRT, Type No. 10ST6105A (M2000 only)
C34	8S10191B07	.047 10%, 400V; Polyester	MECHANICAL PARTS		
C35	8S10212B20	0.47 10%, 400V; Mtlz. Poly.	P3	42D25298A03	Connector, Anode (M1000 only)
C36	21S180C41	.0027 10%, Z5F, 500V; Cer. Disc		42D25298A08	Connector, Anode (M2000 only)
C37	8S10191A53	0.22 10%, 160V; Polyester		28S10586A14	Connector, Circuit Card; 3-contacts
C38	23C42674B21	1800, 16V; lytic		26C25198A03	Heat Sink (for Q8)
C40	21S180C07	15 pF 10%, N150; Cer. Disc		26S10251A08	Heat Sink (for Q12)
C41	21S180B89	180 pF 10%, Z5F 100V; Cer. Disc	S3	15S10183A87	Housing, Receptacle; 3-contact (less contacts)
C42	21S180C82	33 pF 10%, N150; Cer. Disc		39S10184A72	Contact, Receptacle (3 Req'd for S3)
C44	8S10169B71	.033 10%, 400V; Mylar (M2000 only)		14A25340A01	Insulator, Hi-Voltage Standoff (M2000 only)
DIODES				2S10054A36	Nut, Clip-on #8-18 (M1000 only)
D1	48D67120A11	Diode, Low Power; All		42C25258A01	Retainer, CRT (M1000 only)
D2	48S191A05	Rectifier, Silicon; 91A05		3S138210	Screw, #8-18 x 1-1/4" (M1000 only)
D3-D6	48D67120A11	Diode, Low Power; All		26C25323A01	Shield, Linearity (CRT)
D7-D9	48S191A05	Rectifier, Silicon; 91A05		9D25241A04	Socket, CRT (Incl. leads and resistors R20, R65, R66 & R67)
D10	48S134921	Diode, D1D		41B25268A03	Spring, CRT Aquadag (M1000 only)
D11	48S191A05	Rectifier, Silicon; 91A05		41D65987A01	Spring, Special; CRT Aquadag Gnd (M2000 only)
D12	48S137608	Diode, D9H (M1000 only)		42D67027A14	Strap, CRT Mtg. (M2000 only)
D12	48S137622	Diode, D9N (M2000 only)		7S10747A02	Support Guide, Circuit Card
D13	48D67120A11	Diode, Low Power; All			
INTEGRATED CIRCUIT					
IC1	51S10778A01	MC1391P; T3L			
COILS/CHOKES					
L1	24D25248B07	Coil, Horiz. Width (M1000 only)			
L1	24D25248B08	Coil, Horiz. Width (M2000 only)			
L2	25D25221A09	Choke, Vert. Out			
L3A/B	24D25290A02	Yoke, Deflection (M1000 only)			
L3A/B	24D68531A03	Yoke, Deflection (M2000 only)			